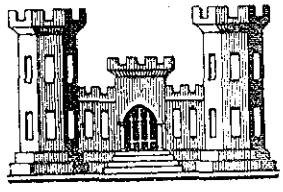
TIDAL FLOOD DAMAGE STUDY

WAREHAM, MASSACHUSETTS

Prepared for the Department of Housing and Urban Development's Flood Insurance Investigation, Authorized by Public Law 339 of the 89th Congress, Approved November 8, 1965.



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JUNE 1966

FLOOD INSURANCE STUDY

WAREHAM, MASSACHUSETTS

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

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FLOOD INSURANCE STUDY

WAREHAM, MASSACHUSETTS

1. GENERAL

This report presents the results of a study of flood losses due to tidal flooding in the Town of Wareham, Massachusetts. The Department of Housing and Urban Development, directed by Congress (Section 5 of P. L. 89-339, 79 Stat. 1301) to make a study of possible Federal programs which could be established to help provide financial assistance to those suffering property losses in floods, requested the Chief of Engineers to collect, analyze, and develop technical data on such losses. Wareham is one of seven pilot areas chosen for detailed study.

2. SCOPE OF INVESTIGATION

The study comprised a field examination of all properties subject to hurricane-induced tidal flooding in the concentrated beach areas by damage appraisers; a compilation of assessed values of all properties in the flood plain; office studies to determine average annual losses by property and to relate these losses to floor area subject to flooding and to value of property and the preparation of a report setting forth the results of the study. In deriving annual losses an IBM 7044 computer was used.

3. DESCRIPTION OF AREA

Wareham is located at the head of Buzzards Bay on the south coast of Massachusetts. Buzzards Bay is open to the Atlantic Ocean at its southerly end. The town has 30 miles of water frontage along the shores of Buzzards Bay and the waterways tributary thereto.

The principal water areas in Wareham, from east to west, are Onset Bay, Wareham River or Harbor, and Weweantic River. They are described as follows.

a. Onset Bay. Onset Bay is an indentation approximately 3,000 feet wide and 6,000 feet long in the west shore of Buzzards Bay, at its upper end, near the west entrance to the Cape Cod Canal. Two shallow arms of the bay, each about one mile long, extend beyond the head of the bay to the north and the west, into Broad Cove and Sunset Cove, respectively. An improved channel for navigation has been provided through the bay to the

town wharf at the head of the bay. An anchorage area of about 16 acres and a turning basin have also been provided at the head of the bay. Two islands are located in the bay, Onset Island near the mouth of the bay and a smaller island, Wickets Island, located about 4,000 feet above the mouth.

b. Wareham River. The Wareham River is formed by the confluence of the Wankinco and Agawam Rivers just above the railroad and highway bridges at the lower end of the main business center in Wareham. From this point the river flows generally south about 2.7 miles to its mouth at Buzzards Bay between Cromeset Point on the west and Long Beach Point on the east. The river has a width varying from about 300 to 500 feet in its first $\frac{1}{4}$-mile length below the bridges. It then widens to about 2,000 feet for a distance of about 0.9 mile to a point opposite Swifts Neck where it narrows to about 1,000 feet. Below Swifts Neck the river widens again, attaining a width of approximately 4,000 feet at its mouth 1.5 miles downstream. An improved channel has been provided in the Wareham River to the wharves along the lower waterfront of the town, below the highway bridge. The shores of the river have been intensively developed for residential and recreational use, particularly at Swifts Beach about one mile above the mouth, Hamilton Beach on the west bank, and Parkwood Beach on the opposite east bank, about 1.5 miles above the mouth, and Pinehurst Beach about 0.3 mile further upstream on the west bank. The drainage area of the Wareham River is approximately 47 square miles.

Wankinco River. This river is formed by the confluence of minor streams on the town line between Carver and Plymouth. It flows generally south about two miles to the Wareham line, then an additional 3.5 miles through Wareham to its juncture with the Agawam River. In its lower 0.9-mile reach, opposite the main business center of Wareham, the river is tidal. The watershed is extensively used for cranberry culture.

c. Weweantic River. This river rises in the bogs in the western part of Carver, Massachusetts, and flows generally south along a winding route, for approximately 10 miles, to tidewater at the outlet of Horseshoe Pond, thence four miles to its mouth between Cromeset Point on the east and the shores of Great Hill Point on the west. In its lower two-mile reach, below the highway bridge at Route U.S. 6, the river has a width varying from about 600 to 1,500 feet. The natural channel in this lower reach of the river, which forms a part of the boundary between Marion and Wareham, is narrow and winding with depths varying from 5 to 14 feet. The Weweantic River has a drainage area of about 88 square miles.

Much of the water frontage consists of sandy beaches and sizeable colonies of housing, both seasonal and year round, have been developed at the more desirable beach locations.

4. ECONOMIC DEVELOPMENT

a. Population. The Town of Wareham, which rightfully calls itself "Gateway" to Cape Cod, had a 1965 year round population of 10,406. Over the past two decades the town has had an annual growth rate in population in excess of 2.5%. While there has been a slackening in the growth rate in the recent past the long range trend in the town is expected to bring continued growth at the historic rate. The population of the town is estimated to increase from 100 to 200 percent in the summer time with the influx of cottagers at the town's beaches.

b. Economy. The economy of Wareham today is based primarily on water-oriented recreation. Agriculture, centered in the cultivation, packaging, and shipment of cranberries, is a major user of land in Wareham and formerly was a large employer of local labor but currently it imports much of its labor force on a seasonal basis.

The recreational aspects of its beaches and its location at the west end of Cape Cod are the two largest factors in Wareham's present development. The summer cottagers at its beaches are drawn there by excellent swimming, boating, and fishing.

Four large marinas and two boat yards are engaged in servicing the fleet of pleasure craft based in the Wareham area. One of the yards manufactures plastic boats ranging in size from dinghies to 44-foot long cruisers. The pleasure craft fleet was estimated to be in excess of 700 boats in 1961 and it has been increasing annually since that time.

Situated at the junction of two of the three principal access roads to Cape Cod, Mass.-U.S. 6 and Mass. State Route 28, Wareham also has a thriving tourist industry catering to the thousands of visitors to Cape Cod who use these roads each year. In addition to the tourist-oriented commercial facilities which bulk large in Wareham's economy the Town, the largest between the Cape proper and New Bedford, is the banking, shopping, and service center for its surrounding communities.

5. FLOOD PROBLEM

Wareham has been troubled with tidal flooding for years. The problem has been accentuated in recent years by the occurrence of two large hurricanes which caused extreme levels of flooding in the town, one in September 1938, the other, Hurricane Carol of August 31, 1954 and two other hurricanes in the same period in 1944, and 1960 (Donna) caused moderate flooding. However, it is not only hurricanes which occasion tidal flooding; the

large coastal storms of the region (northeasters) have also caused flooding in Wareham.

6. TIDAL HYDRAULICS

The mean range of the tide at the entrance to Wareham Harbor is 4.1 feet, with mean high water at elevation of 2.35 feet, msl. Spring tides have an average range 5.1 feet, and maximum range of 6.7 feet. A mean spring tide will reach an elevation at Wareham of 3.1 feet, msl. The tidal ranges and elevations in Onset Bay correspond to those in Wareham Harbor. The time interval for a complete tidal cycle averages about 12 hours and 25 minutes. This results in the daily occurrence of two low and two high waters on an average of six out of every seven days.

7. TIDAL SURGES

Flooding results from the movement of a storm surge, or rise in water level, onto a shoaling coast or into a bay or inlet. The surge is caused by a combination of high winds, sometimes of hurricane velocity, and low barometric pressure. Usually the rise of the sea is rapid as the center of a major hurricane approaches.

The level of the storm surge is increased by a rising ocean bed and favorable shore contours, factors which similarly affect the predicted normal tide in shore locations. These favorable factors for a storm surge are present at Wareham. The ordinary rise of the tide amounts to only one or two feet in the open ocean while its average range varies from about 2.0 to 7.5 feet at points along the southern New England coast. A well defined storm surge is not developed unless the slope of the ocean bed and the contour of the coastline are favorable to its rise, in combination with the proper direction of the storm track and speed of movement.

8. PREDICTED NORMAL TIDE AND TIDAL FLOODING

An important factor in determining the height of flooding from a tidal surge is the stage of the normal tide at the time the hurricane surge arrives at the coast. The surge in the September 1938 hurricane added 11.1 feet to the predicted normal tide at Wareham and caused flooding to an elevation of 14.2 feet, msl (approximately 11.8 feet, mhw). The hurricane of 31 August 1954 (Carol), with an 11.3-foot surge, caused flooding to an elevation of 13.6 feet, msl.

A curve of stage versus frequency of occurrence for the Wareham area developed in connection with the authorized but deferred Hurricane Protection Project for Wareham was used in determining the zones of flooding. The curve is shown on Plate 2.

In the preparation of tidal elevation-frequency data for the Wareham-Marion area, consideration was given to similar data which has been prepared for Newport Harbor, Rhode Island, which lies about 35 miles southwest of Wareham. The mean tide range at Newport Harbor is 3.5 feet; at the mouth of Wareham River, 4.1 feet. The tidal elevation-frequency curve for the Wareham River area is based on (1) observed tidal-flood elevations for the 1938, 1944, 1954 (Carol), and 1960 (Donna) hurricanes, and (2) Newport Harbor tidal elevation-frequency data stage related to the Wareham River area. The Wareham River frequency curve represents a composite curve based on a 326-year period, 1635-1960, a 146-year period, 1815-1960, that influence the upper portion of the curve, and a 30-year period, 1931-1960, for which there is a continuous tide gage record, that determines the lower portion of the curve.

9. FIELD STUDY

In the field investigations the town was divided into eight beach areas and the commercial center of the town. The areas are described below and shown by letter designation on Plate 1.

a. Briarwood Beach. This area in the southwest portion of Wareham on the shore of the Weweantic River estuary has 110 residential properties and one commercial venture. About 29% of the properties are year round dwellings. Of the remaining 71% about 16 are of such construction that they can readily be converted to year round use. The letter "B" is used to designate the area on Plate 1 and as an area designator for individual properties in the tabulations.

b. Cromeset. This is a long neck of land to the southeast of Briarwood between the Weweantic and Wareham Rivers. The northerly, higher end of this neck is already built over with year round residential properties and building is continuing in a southerly direction. In the southerly portion there are at present 23 seasonal dwellings and 20 year round homes in the flood zone. Most of the year round homes are converted seasonal properties. The area is designated "C" on Plate 1 and the letter used as a designator in the tabulation.

c. Swifts Beach. This beach, the most exposed of Wareham's beaches to tidal action, is located to the south of the Wareham business district at the head of Buzzard's Bay. It is densely built-over with dwellings, mainly seasonal in character. As opposed to the other beach areas in Wareham where most dwellings are owner-used there are a large number of summer rental properties at this beach. Of the total of 365 properties in this area 24 are year round and 81 are capable of year round occupancy (convertible). This area is designated "S" on Plate 1 and the letter "S" is also used as a designator in the tabulation.

d. Hamilton Beach. This small beach is on a point which is an easterly extension of Swift's Beach. On the average the homes at this beach are of higher quality than at any other beach in Wareham. Of the 107 properties in the flood zone all but 53 are year round or convertible thereto. The letter "H" is the designator for this beach on the plan and in the tabulation.

e. Pinehurst. This beach, located just to the south of Wareham Center is one of the older areas in Wareham. Of the 109 properties at this beach 67 are seasonal, 18 are year round and 24 are capable of year round use. The letters "PH" designate this area on Plate 1 and in the tabulations.

f. Parkwood. This beach, located across the Wareham River's mouth from Hamilton Beach is one of the better areas in Wareham in quality of its homes. Of the 62 properties in the flood zone all but 23 are year round or convertible thereto. The letters "PW" designate this area on Plate 1 and in the tabulations.

g. Onset. Onset is divided into two areas east and west of the East River which extends Onset Bay into Broad Cove. On the east side of the river there are a variety of commercial rooming establishments (seasonal), and stores, and the rest of the 121 properties are residential, mainly seasonal. The designator for this area is the letter "O". On the west side of the river there are 150 properties in the flood zone. They are classified as year round solely because they are so used; it is actually a distressed area whose occupants can't afford better housing. Because of the uniformity of character of the dwellings and the flatness of the area a sample of 29 surveyed properties was extrapolated for the entire area. The letters "ON" designate this area on Plate 2 and in the tabulations.

h. Wareham Center. The business and commercial center of Wareham is concentrated along the Main Street. A variety of enterprises

from lunch rooms to a department store are located in this area. On the Wareham River at the east end of the business district are two large boatyards, a cranberry packaging plant and a builder's supply firm. The area is designated "W" on Plate 1 and in the tabulations.

10. SURVEY METHODS

a. General. In each of the areas surveyed the first floor elevation and area was determined for each property. The location of each property was marked on prints of assessor's plans of the area for future reference in determining assessed values of surveyed properties. Damage analysts then surveyed each property. The stage where damage starts, referred to first floor stage, was determined; also the stages at which significant increases in losses would occur. Losses were determined for all properties up to elevation 16 feet, mean sea level, the stage of a 200 year event. Losses to structures were estimated directly by the damage analysts. For losses to contents of structures, owners or tenants were consulted when on the premises-window inspections were made of unoccupied properties. Real estate agents who specialized in beach property rentals and sales were also consulted as to type and value of contents in beach properties. The survey was carried out during April and part of May 1966 and the price level used was in 1966 dollars.

b. Types of Properties. For residential properties buildings were broken down into three categories; seasonal, seasonal convertible to year round and year round dwellings. These three categories covered over 99% of all properties surveyed. In the Cape Cod area the record of the better classes of seasonal property is one of the owners winterizing their properties and using them as year round retreats as the families grow up and finally using them as retirement homes. The equable winter climate on the south side of Cape Cod and the continuously improving highway network connecting the area to the large metropolitan areas of eastern New England are major factors in this conversion. The criteria for the seasonal-convertible category were: a masonry foundation, either poured concrete or concrete block on poured footings, a sound structural framework, finished interior and capability of having heating provided.

Commercial properties were categorized as wholesale, retail and marine. The last category covered the boat yards in Wareham Center.

There were no public buildings or industrial plants in the flood zone.

c. Effects of Tidal Flooding. In evaluating losses, consideration was given to the following factors:

(1) Damage from inundation.

(2) Damage from the corrosive effects of salt water.

(3) The buoyant effect of water on wooden structures, especially when buildings are on piers rather than masonry foundations.

No attempt was made to evaluate wave action due to the unknowns involved but in exposed areas such as Swifts Beach losses could be increased substantially by such action.

d. Other Field Work. In addition to the damage surveys detailed above, the field investigation also included obtaining the assessed values of all properties surveyed from the local assessors and discussions with assessors, realty brokers and banking officials to relate assessed values to market values of properties. In the discussions with local bank officials it was learned that some flood insurance was offered in the past on properties situated at or above the level of the 1938 tidal flood but that the premium, $82 per thousand dollars of value, was so high that little was sold. It was also learned that the banks will lend mortgage money on properties in the flood zone but are reluctant to do so on exposed waterfront properties.

11. OFFICE STUDIES

Basic data from the field surveys were tabulated in the office and transferred to punched cards to serve as input data for a computer program developed to determine average annual losses.

Input data included file numbers, damage category (structure or personal property), depth-damage data, first floor area and type of residence (year round, convertible or seasonal). The depth-damage data for each property were combined with depth-frequency data to obtain damage-frequency data used to compute the average annual loss by the arithmetic method. The average annual loss for each damage category was divided by the first floor area to obtain an annual loss per square foot. The basic program, written in Fortran II, is attached as an appendix. The program is a general one suitable for the development of annual losses at any location by the insertion of the proper elevation-frequency data.

The program was also developed to classify each property into one of the six flood risk zones listed below.

Zone	Frequency in Years	Elev. in feet (msl)
1	0 to 5	4.8 to 8.0
2	5 to 10	8.0 to 9.6
3	10 to 25	9.6 to 11.7
4	25 to 50	11.7 to 13.2
5	50 to 100	13.2 to 14.7
6	100 to 200	14.7 to 16.0

The output data included file number, type of residence, damage category, flood risk zone, average annual loss, first floor area and square foot loss.

The flood risk zone in which the program placed each property was a function of the elevation at which damage began to the structure for that property. From an insurance analysis viewpoint, this is correct. Generally, the risk zone determined by the computer coincides with the risk zone determined by topography. In some instances, however, where construction took into account the threat of tidal flooding, a property could be in a topographic risk zone of frequent flooding but in a statistical risk zone of much rarer frequency. The incidence of such occurrences is quite low and for this study was not enumerated. Plate 1 shows the study areas and the 5-year, 25-year and 50-year event limits in these areas. The scale of the plate precludes showing other intermediate zones.

A second program was developed to obtain a summary of the results from the first program. The program determined the total average annual loss and total annual loss per square foot in each flood risk zone for each type of residence and commercial property. Summary results are shown on Table 2.

12. DEPTH-DAMAGE ESTIMATES

Because the computer program was developed to analyze annual losses for each individual property by location and type summary tables of depth damage data were not required or printed out separately. Data is available and the program is susceptible to modification to readily assemble such summaries if the results of further studies in connection with the entire pilot program of flood insurance studies indicate their desirability. A sampling of depth damage data for properties at Hamilton Beach is shown on Tables 1 and 2.

13. SUMMARIES

Tables A, B and C present summaries of all annual losses in Wareham. Tables B1a through C2a present the breakdown for Tables A, B and C.

14. DISCUSSION

a. Accuracy. In view of the detailed field survey carried out in this study, the stage-loss data is considered reliable both as to loss values and to stage. The stage-frequency data was given careful consideration in the preparation of the Survey Report on Wareham-Marion (1961) and the curve, as used in this report is the same one used in the Survey Report and has been reviewed by the Office of the Chief of Engineers. The annual loss data developed in the study is therefore considered reliable. The topography of Wareham in the beach areas precluded properties in the range beyond the 100-year event. Some properties were surveyed with floor elevations between elevation 15.0 feet msl and 16.0 feet msl., the elevation limits of the 100-year to 200-year range. When the loss data was combined with stage-frequency the annual damage was too small to record.

b. Applicability. From the size of the sample and the general uniformity of rates of damages it would appear that the data assembled for Wareham would have applicability to all areas on the Southern New England coast subject to tidal flooding.

c. Local Action. The Chief of Engineers has recommended a series of barriers for Wareham which was approved by Congress (P. L. 87-874) but the local people are unwilling to furnish the required local contribution to the cost. Design of the project, which would prevent flooding in over 90% of the studied areas has been deferred. No other action is possible to property owners in the flood zone except to raise their structures on sound foundations.

TABLE 1

TYPICAL DEPTH DAMAGE DATA
SELECTED PROPERTIES - HAMILTON BEACH

File No.	Property	Loss to Structures ($1,000)									
		Stage in Feet	Zero Stage 1954			Flood Crest 13.6 ft., msl					
			-6	-5	-4	-3	-2	-1	0	+1	+2	+3
	Year Round											
H-1	Palsano				0	0.5	0.8	1.8	3.3	4.7	5.9	7.3
H-2	"Little Ann"			0	0.7	1.2	2.7	3.6	4.5	5.1	5.7	6.4
H-8	Del Vecchio				0	0.1	0.4	0.4	0.5	2.7	4.5	6.1
H-13	Algelo						0	1.1	1.5	3.2	4.8	6.8
H-15	"C"							0	1.1	1.5	3.1	5.2
	Convertible											
H-3	Dodero				0	0.4	1.7	2.6	3.3	3.5	3.8	4.1
H-4	Riggi			0	1.8	3.0	4.2	4.8	5.4	6.0	6.5	7.0
H-5	Rogers			0	0.2	1.5	2.6	3.5	4.1	4.7	5.2	5.8
H-6	Wallace			0	0.2	0.5	1.7	2.7	3.2	3.8	4.3	4.8
H-7	Burton			0	0.4	1.6	2.6	3.1	3.7	4.3	4.8	5.4
H-16	Moran						0	0.5	1.6	2.7	4.6	5.5
	Seasonal											
H-9	Riccio						0	0.4	1.3	2.6	3.6	4.6
H-10	Riccialto						0	0.4	1.6	2.6	3.5	4.4
H-11	"Cota's"					0	0.5	1.9	3.2	4.3	4.8	5.4
H-12	Angelo					0	0.4	1.1	2.3	3.3	3.9	4.5
H-14	Wanda						0	0.3	0.5	1.9	3.3	4.7

TABLE 2

TYPICAL DEPTH DAMAGE DATA
SELECTED PROPERTIES - HAMILTON BEACH

File No.	Property	Zero Stage 1954	Loss to Contents ($1,000) Flood Crest 13.6 ft., msl									
	Stage in Feet		-6	-5	-4	-3	-2	-1	0	+1	+2	+3
	Year Round											
H-1	Palsano					0	0.3	0.6	1.3	1.8	2.0	2.1
H-2	"Little Ann"			0	0.3	0.3	0.8	1.3	1.8	2.0	2.1	2.3
H-8	Del Vecchio				0	0.1	0.2	0.3	0.3	1.0	1.6	2.0
H-13	Algelo						0	0.4	0.4	1.4	2.2	2.7
H-15	"C"							0	0.3	0.4	0.9	1.6
	Convertible											
H-3	Dodero					0	0.5	1.0	1.4	1.6	1.8	1.8
H-4	Riggi		0	0.1	0.5	1.0	1.4	1.6	1.8	2.0	2.1	2.3
H-5	Rogers				0	0.4	1.0	1.4	1.6	1.7	1.9	1.9
H-6	Wallace			0	0.2	0.4	1.0	1.6	1.9	2.2	2.3	2.3
H-7	Burton			0	0.2	0.7	1.1	1.4	1.6	1.8	1.9	2.0
H-16	Moran						0	0.1	0.6	1.2	1.6	1.8
	Seasonal											
H-9	Riccio						0	0.1	0.5	1.0	1.5	1.7
H-10	Riccialto						0	0.1	0.5	1.0	1.3	1.5
H-11	"Cota's"					0	0.2	0.6	1.1	1.6	1.8	2.0
H-12	Angelo						0	0.4	1.0	1.3	1.4	1.5
H-14	Wanda						0	0.1	0.1	0.6	1.1	1.1

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
A

Category and Class of Property: All Structures and Personal Property

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	250	163	456	106	116	0	1091
Value of Units ($1,000)							
Average	9.6	9.4	8.3	7.5	6.4		8.5
Total	2409.2	1532.9	3764.4	791.8	743.5		9241.8
Area of 1st fl (1000 Sq Ft)							
Range	0.5-40.0	0.3-8.0	0.3-37.6	0.5-2.3	0.5-1.2		0.3-40.0
Average	1.1	0.9	0.9	0.8	0.7		0.9
Total	273.6	146.2	409.6	86.7	83.8		999.9
Average Annual Dam ($1,000)							
Average	0.56	0.33	0.15	0.05	0.02		0.24
Total	139.04	53.81	66.18	4.81	1.78		265.62
Rate of Damages, Average							
Anl. Dam $/$1000 Value	57.70	35.10	17.60	6.10	2.40		28.70
Anl. Dam $/1000 Sq Ft	508.20	368.00	161.60	55.50	21.20		265.60
No. of Units in Sample	173	145	420	106	116	0	960

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B

Category and Class of Property: Resid., Structures and Personal Property

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	234	153	431	103	115	0	1036
Value of Units ($1,000)							
Average	5.3	6.1	6.4	6.5	6.4		6.1
Total	1232.1	933.9	2758.6	670.0	735.3		6329.9
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.4	0.6-1.7	0.4-1.8	0.5-1.2	0.5-1.2		0.4-1.8
Average	0.7	0.8	0.8	0.8	0.7		0.8
Total	173.1	122.9	338.9	82.2	83.2		800.3
Average Annual Dam ($1,000)							
Average	0.45	0.25	0.11	0.04	0.02		0.19
Total	105.88	38.39	47.50	3.78	1.74		197.29
Rate of Damages, Average							
Anl. Dam $/$1000 Value	85.90	41.10	17.20	5.60	2.40		31.20
Anl. Dam $/1000 Sq Ft	611.70	312.30	140.10	46.00	20.90		246.50
No. of Units in Sample	157	135	395	103	115	0	905
Selected Samples							
Value ($1,000)	13.3	7.4	9.1	17.0	7.4		
Rate $/$1,000 Value	13.10	60.90	8.40	5.40	4.40		
Rate $/1,000 Sq Ft	242.00	446.00	63.00	94.00	48.00		
Value ($1,000)	6.0	5.9	7.2	7.0	7.2		
Rate $/$1,000 Value	47.70	32.20	10.60	8.20	21.20		
Rate $/1,000 Sq Ft	434.00	203.00	88.00	48.00	17.00		
Value ($1,000)	5.7	5.6	6.8	5.5	7.0		
Rate $/$1,000 Value	55.10	36.60	3.90	8.50	6.60		
Rate $/1,000 Sq Ft	270.00	192.00	48.00	71.00	80.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1

Category and Class of Property: Resid., Structures, Frame, 1 Story, 1 Family

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	234	153	431	103	115	0	1036
Value of Units ($1,000)							
Range	0.9-13.5	0.9-18.0	0.9-13.5	1.5-13.5	2.4-13.5		0.9-18.0
Average	4.1	4.9	5.2	5.4	5.2		4.9
Total	961.4	745.2	2245.8	551.1	603.2		5106.7
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.4	0.6-1.7	0.4-1.8	0.5-1.2	0.5-1.2		0.4-1.8
Average	0.7	0.8	0.8	0.8	0.7		0.8
Total	173.1	122.9	338.9	82.2	83.2		800.3
Average Annual Dam ($1,000)							
Average	0.34	0.20	0.09	0.03	0.01		0.15
Total	79.57	29.91	36.96	2.95	1.45		150.84
Rate of Damages, Average							
Anl. Dam $/$1000 Value	82.80	40.10	16.50	5.30	2.40		29.50
Anl. Dam $/1000 Sq Ft	459.70	243.30	109.10	35.90	17.40		188.50
No. of Units in Sample	157	135	395	103	115	0	905
			Selected Samples				
Value ($1,000)	11.4	10.5	12.0	13.5	13.5		
Rate $/$1,000 Value	15.80	33.90	11.20	3.50	1.50		
Rate $/1,000 Sq Ft	222.00	512.00	79.00	41.00	16.00		
Value ($1,000)	5.4	6.6	6.0	6.0	5.40		
Rate $/$1,000 Value	109.00	18.55	10.20	7.80	2.45		
Rate $/1,000 Sq Ft	594.40	157.00	87.00	39.00	30.00		
Value ($1,000)	0.9	0.9	0.9	1.5	2.4		
Rate $/$1,000 Value	357.30	245.60	90.10	5.50	5.60		
Rate $/1,000 Sq Ft	893.00	470.00	159.00	17.00	19.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2

Category and Class of Property: Resid., Personal Property, Frame, 1-Story, 1 Family

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	234	153	431	103	115	0	1036
Value of Units ($1,000)	0.4-8.0	0.4-3.5	0.3-3.5	0.3-6.0	0.4-4.0		0.3-8.0
Range	1.2	1.2	1.2	1.2	1.1		1.2
Average	270.7	188.7	512.8	118.9	132.1		1223.2
Total							
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.4	0.6-1.7	0.4-1.8	0.5-1.2	0.5-1.2		0.4-1.8
Average	0.7	0.8	0.8	0.8	0.7		0.8
Total	173.1	122.9	338.9	82.2	83.2		800.3
Average Annual Dam ($1,000)							
Average	0.11	0.06	0.02	0.008	.003		0.04
Total	26.31	8.48	10.53	0.83	0.29		46.44
Rate of Damages, Average							
Anl. Dam $/$1000 Value	97.20	44.90	20.50	7.00	2.20		38.00
Anl. Dam $/1000 Sq Ft	152.00	69.00	31.10	10.10	3.50		58.00
No. of Units in Sample	157	135	395	103	115		905
		Selected Samples					
Value ($1,000)	3.0	3.0	3.0	3.5	2.8		
Rate $/$1,000 Value	2.20	10.60	6.70	10.20	11.00		
Rate $/1,000 Sq Ft	6.00	26.00	15.00	36.00	28.00		
Value ($1,000)	1.8	1.5	1.0	2.0	1.0		
Rate $/$1,000 Value	31.10	26.50	14.90	7.70	0.90		
Rate $/1,000 Sq Ft	62.20	68.50	8.40	13.00	1.00		
Value ($1,000)	0.4	0.4	0.3	0.3	0.4		
Rate $/$1,000 Value	559.40	201.00	4.70	7.50	1.20		
Rate $/1,000 Sq Ft	688.00	115.00	2.80	6.00	0.80		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
C

Category and Class of Property: Commercial, Structures and Personnel Property

Item	Flood Risk Zone by Frequency in Years						
	0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	16	10	25	3	1	0	55
Value of Units ($1,000)							
Range							
Average	73.6	59.9	40.2	40.6	8.2		52.9
Total	1177.1	599.0	1005.8	121.8	8.2		2911.9
Area of 1st fl (1000 Sq Ft)							
Range	0.7-40.0	0.3-8.0	0.3-37.6	0.8-2.3	0.6		0.3-40.0
Average	6.3	2.3	2.8	1.5	0.6		3.6
Total	100.5	23.3	70.7	4.5	0.6		199.6
Average Annual Dam ($1,000)							
Average	2.07	1.54	0.75	0.34	0.04		1.24
Total	33.16	15.42	18.68	1.03	0.04		68.33
Rate of Damages, Average							
Anl. Dam $/$1000 Value	28.20	25.70	18.60	8.50	4.90		23.50
Anl. Dam $/1000 Sq Ft	330.00	661.80	264.20	68.70	6.70		342.30
No. of Units in Sample	16	10	25	3	1	0	55

SUPPLEMENTARY TABLES

Supplementary tables B-1ay through B-2ds which follow present a breakdown of residential properties by types.

Tables H-1 and H-2 are typical input and output data for properties at Hamilton Beach. The first entry for each property is the structural data, the second entry is the content data.

Table S-1 is a summary of annual losses and values.

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1a

Category and Class of Property: Resid., Struct., Frame, 1 story, with Basement, 1 Family

Item	Flood Risk Zone by Frequency in Years						
	0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	34	43	119	18	24	0	238
Value of Units ($1,000)							
Range	3.0-13.5	3.0-18.0	2.7-13.5	3.0-13.5	2.4-9.6		2.4-18.0
Average	7.2	6.9	6.4	6.0	5.7		6.4
Total	242.7	274.0	764.3	107.7	135.8		1,524.5
Areas of 1st fl (1000 Sq Ft)							
Range	0.6-1.4	0.6-1.4	0.5-1.8	0.6-1.2	0.5-1.1		0.5-1.8
Average	0.9	0.9	0.9	0.9	0.8		0.9
Total	31.3	40.1	105.3	16.5	19.0		212.2
Average Annual Dam ($1,000)							
Average	0.30	0.17	0.09	0.04	0.02		0.13
Total	10.07	7.52	11.26	0.70	0.41		29.96
Rate of Damages, Average							
Anl. Dam $/$1000 Value	41.50	27.50	14.70	6.50	3.00		19.70
Anl. Dam $/1000 Sq Ft	321.70	187.50	106.90	42.70	21.80		141.20
No. of Units in Sample	34	43	119	18	24	0	238
			Selected Samples				
Value ($1,000)	11.4	7.5	9.6	13.5	5.1		
Rate $/$1,000 Value	15.80	23.60	4.00	4.2	2.90		
Rate $/1,000 Sq Ft	222.00	180.00	38.00	59.00	24.00		
Value ($1,000)	5.4	6.6	6.0	6.0	5.1		
Rate $/$1,000 Value	109.00	18.55	10.20	7.80	3.80		
Rate $/1,000 Sq Ft	594.40	157.00	87.00	39.00	30.00		
Value ($1,000)	3.0	4.5	3.0	3.6	2.4		
Rate $/$1,000 Value	47.50	55.22	27.60	4.90	5.60		
Rate $/1,000 Sq Ft	234.00	319.00	110.00	31.00	19.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-lay

Category and Class of Property: Resid., Struc., Frame, 1 story, with Basement, 1 Family, Year Round

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	16	25	55	11	8	0	115
Value of Units ($1,000)							
Range	3.8-12.0	3.0-18.0	3.0-13.5	3.0-13.5	4.8-9.0		3.0-18.0
Average	7.2	6.6	7.6	6.2	6.6		7.1
Total	114.5	164.0	418.0	68.7	51.3		816.5
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.4	0.6-1.4	0.6-1.5	0.6-1.2	0.6-1.1		0.6-1.5
Average	1.0	0.9	0.9	1.0	0.9		0.9
Total	15.9	23.2	52.3	11.2	6.9		109.5
Average Annual Dam ($1,000)							
Average	0.36	0.18	0.12	0.05	0.02		0.15
Total	5.68	4.62	6.47	0.51	0.16		17.44
Rate of Damages, Average							
Anl. Dam $/$1000 Value	49.60	28.20	15.50	7.40	3.10		21.40
Anl. Dam $/1000 Sq Ft	356.90	199.00	123.80	45.20	23.40		159.30
No. of Units in Sample	16	25	55	11	8	0	115
			Selected Samples				
Value ($1,000)	12.0	18.0	13.5	13.5	9.0		
Rate $/$1,000 Value	11.50	15.60	7.30	4.20	2.30		
Rate $/1,000 Sq Ft	192.00	203.00	93.00	59.00	19.00		
Value ($1,000)	5.4	6.6	4.2	6.0	7.8		
Rate $/$1,000 Value	151.32	22.9	34.40	7.80	2.50		
Rate $/1,000 Sq Ft	719.00	117.00	185.00	39.00	23.00		
Value ($1,000)	3.7	3.0	3.0	3.0	4.8		
Rate $/$1,000 Value	39.20	69.30	27.60	11.60	3.40		
Rate $/1,000 Sq Ft	322.00	168.00	110.00	53.00	21.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study : Pilot
Name : Wareham, Mass.
Source of Flooding: Tidal

TABLE
B-1ac

Category and Class of Property: Resid, Struct., Frame, 1 story, with Basement, 1 Family, Convertible

Item	Flood Risk Zone by Frequency in Years						
	0.5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	15	13	43	5	11	0	87
Value of Units ($1,000)							
Range	3.0-13.5	4.5-8.1	2.7-9.6	4.5-7.5	2.4-9.6		2.7-13.5
Average	7.1	6.0	5.8	6.0	5.8		
Total	106.0	77.1	248.2	30.0	63.0		524.3
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.3	0.8-1.4	0.7-1.8	0.6-1.1	0.5-1.1		0.5-1.8
Average	0.9	1.0	0.8	0.8	0.8		0.8
Total	12.8	12.6	35.3	4.0	9.0		73.7
Average Annual Dam ($1,000)							
Average	0.23	0.17	0.08	0.03	0.02		0.11
Total	3.41	2.21	3.64	.14	.18	0	9.58
Rate of Damages, Average							
Anl. Dam $/$1000 Value	32.20	28.70	14.70	4.60	2.90		18.30
Anl. Dam $/1000 Sq Ft	267.30	175.90	102.90	34.20	20.10		130.00
No. of Units in Sample	15	13	43	5	11	0	87
		Selected Samples					
Value ($1,000)	13.5	8.1	9.6	7.5	9.6		
Rate $/$1,000 Value	12.20	24.40	4.00	2.00	1.60		
Rate $/1,000 Sq Ft	186.00	341.00	38.00	14.00	16.00		
Value ($1,000)	6.0	6.6	6.0	6.0	4.8		
Rate $/$1,000 Value	76.80	18.55	10.20	4.80	2.6		
Rate $/1,000 Sq Ft	577.00	157.00	87.00	39.00	22.00		
Value ($1,000)	3.0	4.5	2.7	4.5	2.4		
Rate $/$1,000 Value	47.50	55.20	24.50	1.20	5.60		
Rate $/1,000 Sq Ft	234.00	319.00	103.00	24.00	19.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Mass.
Source of Flooding: Tidal

TABLE
B-1as

Category and Class of Property: Resid, Struct., Frame, 1 story, with Basement, 1 Family, Seasonal

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	3	5	21	2	5	0	36
Value of Units ($1,000)							
Range	5.4-11.4	3.0-7.5	2.7-9.0	3.6-5.4	3.0-5.1		2.7-11.4
Average	7.4	6.6	4.7	4.5	4.3		5.1
Total	22.2	33.0	98.0	9.0	21.5		183.7
Area of 1st fl (1000 Sq Ft)							
Range	0.8-0.9	0.6-1.1	0.5-1.8	0.6-0.7	0.5-0.8		0.5-1.8
Average	0.9	0.9	0.8	0.6	0.6		0.8
Total	2.6	4.3	17.7	1.2	3.2		29.0
Average Annual Dam ($1,000)							
Average	0.32	0.14	0.05	0.03	0.01		0.08
Total	0.98	0.69	1.15	0.06	0.07		2.95
Rate of Damages, Average							
Anl. Dam $/$1000 Value	44.10	20.90	11.70	6.30	3.40		
Anl. Dam $/1000 Sq Ft	372.30	159.70	64.80	47.40	23.00		101.40
No. of Units in Sample	3	5	21	2	5	0	36
	Selected Samples						
Value ($1,000)	11.4	7.5	9.0	5.4	5.1		
Rate $/$1,000 Value	15.80	23.60	14.20	7.50	2.90		
Rate $/1,000 Sq Ft	222.00	180.00	140.00	62.00	24.00		
Value ($1,000)	5.4	5.4	4.8	-	5.1		
Rate $/$1,000 Value	109.00	14.10	17.50	-	3.80		
Rate $/1,000 Sq Ft	594.40	131.00	89.00	-	30.00		
Value ($1,000)	5.4	3.0	2.7	3.6	3.0		
Rate $/$1,000 Value	39.20	49.30	24.70	4.90	8.60		
Rate $/1,000 Sq Ft	255.00	264.00	101.00	31.00	31.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1d

Category and Class of Property: Resid., Struct., Frame, 1 story, no Basement, 1 Family

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	200	110	312	85	91	0	798
Value of Units ($1,000)							
Range	0.9-9.6	0.9-10.5	0.9-12.0	1.5-13.5	2.4-13.5		0.9-13.5
Average	3.6	4.3	4.7	5.2	5.1		4.5
Total	718.7	471.2	1481.5	443.4	467.4		3582.2
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.2	0.6-1.7	0.4-1.6	0.5-1.2	0.5-1.2		0.4-1.7
Average	0.7	0.8	0.7	0.8	0.7		0.7
Total	141.8	82.8	233.6	65.7	64.1		588.0
Average Annual Dam ($1,000)							
Average	0.35	0.20	0.08	0.03	0.01		0.15
Total	69.50	22.38	25.71	2.25	1.03		120.87
Rate of Damages, Average							
Anl. Dam $/$1000 Value	96.70	47.50	17.30	5.10	2.20		33.70
Anl. Dam $/1000 Sq Ft	490.20	270.30	110.00	34.20	16.10		205.50
No. of Units in Sample	123	92	276	85	91	0	667
Selected Samples							
Value ($1,000)	9.6	10.5	12.0	13.5	13.5		
Rate $/$1,000 Value	49.70	33.90	11.20	3.50	1.50		
Rate $/1,000 Sq Ft	450.00	512.00	79.00	41.00	16.00		
Value ($1,000)	4.8	3.6	4.2	4.5	5.40		
Rate $/$1,000 Value	46.70	71.90	17.40	4.00	2.45		
Rate $/1,000 Sq Ft	311.00	261.00	108.00	34.00	11.00		
Value ($1,000)	0.9	0.9	0.9	1.5	2.4		
Rate $/$1,000 Value	357.30	245.60	90.10	5.50	5.60		
Rate $/1,000 Sq Ft	893.00	470.00	159.00	17.00	27.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1dy

Category and Class of Property: Resid., Struct., Frame, 1 story, no Basement, 1 Family Year Round

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	87	24	56	6	5	0	178
Value of Units ($1,000)							
Range	6.0-9.6	1.5-7.5	1.8-12.0	3.0-13.5	3.0-13.5		1.5-13.5
Average	4.4	4.4	4.8	6.4	5.6		4.7
Total	386.1	106.2	269.4	38.1	27.9		827.7
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.2	0.6-1.3	0.4-1.2	0.6-1.2	0.6-1.1		0.4-1.3
Average	0.7	0.7	0.8	0.8	1.0		0.7
Total	62.7	17.9	42.2	5.0	5.0		132.8
Average Annual Dam ($1,000)							
Average	0.37	0.23	0.10	0.03	0.01		0.24
Total	31.93	5.49	5.74	0.19	0.06		43.41
Rate of Damages, Average							
Anl. Dam $/$1000 Value	82.70	51.70	21.30	5.00	2.30		52.40
Anl. Dam $/1000 Sq Ft	508.90	307.30	135.90	38.20	12.90		32.70
No. of Units in Sample	10	6	24	6	5	0	51
			Selected Samples				
Value ($1,000)	3.0	7.5	12.0	13.5	13.5		
Rate $/$1,000 Value	84.50	27.70	11.20	3.50	1.50		
Rate $/1,000 Sq Ft	276.00	240.00	79.00	41.00	16.00		
Value ($1,000)	9.6	5.4	5.4	3.3	6.0		
Rate $/$1,000 Value	49.70	59.60	34.60	7.30	0.90		
Rate $/1,000 Sq Ft	450.00	319.00	146.00	24.00	5.00		
Value ($1,000)	6.0	1.5	1.8	3.0	3.0		
Rate $/$1,000 Value	63.40	148.30	34.70	13.10	3.30		
Rate $/1,000 Sq Ft	665.00	297.00	166.00	62.00	12.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1dc

Category and Class of Property: Resid., Struct., Frame, 1 Story, no Basement, 1 Family, Convertible

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	12	15	55	11	16	0	109
Value of Units ($1,000)							
Range	2.7-9.0	3.0-10.5	2.7-10.5	3.0-7.8	3.0-9.6		2.7-10.5
Average	5.3	6.1	6.3	4.9	6.1		6.0
Total	63.2	91.2	348.5	54.0	97.2		654.1
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.2	0.6-1.2	0.4-1.6	0.5-1.2	0.5-1.2		0.4-1.6
Average	0.8	0.8	0.9	0.8	0.8		0.8
Total	9.9	12.0	47.4	8.3	13.0		90.6
Average Annual Dam ($1,000)							
Average	0.33	0.25	0.09	0.03	0.01		0.12
Total	3.90	3.81	4.90	0.31	0.21		13.13
Rate of Damages, Average							
Anl. Dam $/$1000 Value	61.80	41.80	14.10	5.80	2.10		20.10
Anl. Dam $/1000 Sq Ft	395.90	316.80	103.50	37.50	15.80		145.00
No. of Units in Sample	12	15	54	11	16	0	108
		Selected Samples					
Value ($1,000)	9.0	10.5	10.5	7.8	9.6		
Rate $/$1,000 Value	41.00	33.90	10.40	5.30	2.00		
Rate $/1,000 Sq Ft	369.00	512.00	97.00	42.00	22.00		
Value ($1,000)	4.8	3.6	4.2	4.5	5.4		
Rate $/$1,000 Value	46.70	71.90	17.40	4.00	2.45		
Rate $/1,000 Sq Ft	311.00	261.00	108.00	34.00	11.00		
Value ($1,000)	2.7	3.0	2.7	3.0	3.0		
Rate $/$1,000 Value	101.40	85.00	27.80	6.30	5.50		
Rate $/1,000 Sq Ft	681.00	383.00	94.00	39.00	40.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-1ds

Category and Class of Property: Resid., Struct., Frame, 1 story, no Basement, 1 Family, Seasonal

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	101	71	201	68	70	0	511
Value of Units ($1,000)							
Range	0.9-8.1	0.9-9.0	0.9-10.5	1.5-12.6	2.4-9.6		0.9-12.6
Average	2.7	3.9	4.3	5.2	4.9		4.1
Total	269.4	273.8	863.6	351.3	342.3		2100.4
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.2	0.6-1.7	0.4-1.6	0.5-1.2	0.5-1.2		0.4-1.7
Average	0.7	0.7	0.7	0.8	0.7		0.7
Total	69.2	52.9	144.0	52.5	46.1		364.7
Average Annual Dam ($1,000)							
Average	0.33	0.18	0.07	0.03	0.01		0.13
Total	33.66	13.08	15.07	1.75	0.76		64.32
Rate of Damages, Average							
Anl. Dam $/$1000 Value	125.00	47.80	17.50	5.00	2.20		197.40
Anl. Dam $/1000 Sq Ft	486.70	247.30	104.60	33.30	16.50		176.40
No. of Units in Sample	101	71	198	68	70	0	508
			Selected Samples				
Value ($1,000)	8.1	9.0	10.5	12.6	9.6		
Rate $/$1,000 Value	60.60	28.60	4.30	2.00	1.90		
Rate $/1,000 Sq Ft	539.00	294.00	80.00	32.00	25.00		
Value ($1,000)	4.2	5.4	9.3	5.4	4.2		
Rate $/$1,000 Value	45.90	28.00	8.30	5.70	1.30		
Rate $/1,000 Sq Ft	315.00	156.00	87.00	44.00	9.00		
Value ($1,000)	0.9	0.9	0.9	1.5	2.4		
Rate $/$1,000 Value	357.30	245.60	90.10	5.50	5.60		
Rate $/1,000 Sq Ft	893.00	470.00	159.00	17.00	27.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2a

Category and Class of Property: Resid., Personal Property, Frame, 1 Story, with Basement, 1-Family

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	34	43	119	18	24	0	238
Value of Units ($1,000)							
Range	0.5-8.0	0.4-3.5	0.3-3.5	0.3-6.0	0.4-4.0		0.3-8.0
Average	1.5	1.7	1.6	1.7	1.3		1.6
Total	50.9	74.3	185.1	30.2	30.7		371.2
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.4	0.6-1.4	0.5-1.8	0.6-1.2	0.5-1.1		0.5-1.8
Average	0.9	0.9	0.9	0.9	0.8		0.9
Total	31.3	40.1	105.3	16.5	19.0		212.2
Average Annual Dam ($1,000)							
Average	0.08	0.05	0.02	0.01	0.002		0.03
Total	2.76	2.26	2.95	0.22	0.05		8.24
Rate of Damages, Average							
Anl. Dam $/$1000 Value	54.20	30.40	15.90	7.30	1.60		22.20
Anl. Dam $/1000 Sq Ft	88.30	56.40	28.00	13.10	2.50		38.80
No. of Units in Sample	34	43	119	18	24	0	238
		Selected Samples					
Value ($1,000)	2.5	3.0	2.5	1.2	2.0		
Rate $/$1,000 Value	53.10	50.70	4.50	4.60	1.50		
Rate $/1,000 Sq Ft	151.00	155.00	9.40	6.80	4.00		
Value ($1,000)	1.8	1.5	1.0	0.8	1.0		
Rate $/$1,000 Value	31.10	26.50	14.90	1.60	1.20		
Rate $/1,000 Sq Ft	62.20	68.50	8.40	1.80	1.60		
Value ($1,000)	0.5	0.8	0.3	0.4	0.4		
Rate $/$1,000 Value	9.80	28.50	4.70	15.80	1.20		
Rate $/1,000 Sq Ft	7.00	27.80	2.80	10.00	0.80		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2ay

Category and Class of Property: Resid., Personal Property, Frame, 1 story, with Basement, 1 Family, Year Round

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	16	25	55	11	8	0	115
Value of Units ($1,000)							
Range	0.5-8.0	0.8-3.5	0.8-3.5	0.3-6.0	1.0-4.0		0.3-8.0
Average	1.5	1.8	2.1	2.3	1.9		2.0
Total	24.0	45.0	115.5	25.3	15.2		225.0
Area of lst fl (1000 Sq Ft)							
Range	0.6-1.4	0.6-1.4	0.6-1.5	0.6-1.2	0.6-1.1		0.6-1.5
Average	1.0	0.9	0.9	1.0	0.9		0.9
Total	15.9	23.2	52.3	11.2	6.9		109.5
Average Annual Dam ($1,000)							
Average	0.11	0.06	0.04	0.02	0.003		0.05
Total	1.83	1.50	1.98	0.19	0.03		5.53
Rate of Damages, Average							
Anl. Dam $/$1000 Value	76.20	33.30	17.10	7.50	2.00		24.60
Anl. Dam $/1000 Sq Ft	114.80	64.80	37.90	17.40	3.70		50.60
No. of Units in Sample	16	25	55	11	8	0	115
Selected Samples							
Value ($1,000)	2.0	2.0	2.0	2.5	2.0		
Rate $/$1,000 Value	48.00	39.00	20.70	3.40	1.40		
Rate $/1,000 Sq Ft	84.00	62.00	45.00	18.00	4.00		
Value ($1,000)	1.5	1.5	3.5	2.0	2.0		
Rate $/$1,000 Value	33.00	32.50	12.80	12.00	2.90		
Rate $/1,000 Sq Ft	75.00	52.00	40.00	7.00	7.00		
Value ($1,000)	1.8	2.5	1.2	2.5	4.0		
Rate $/$1,000 Value	95.10	3.30	48.70	18.00	0.20		
Rate $/1,000 Sq Ft	144.00	7.0	81.00	4.80	1.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2ac

Category and Class of Property: Resid., Personal Property, Frame 1-story, with Basement, 1-Family, Convertible

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	15	13	43	5	11	0	87
Value of Units ($1,000)							
Range	0.5-2.5	0.8-3.0	0.6-2.5	0.5-1.2	0.8-2.0		0.5-3.0
Average	1.8	1.4	1.2	0.8	1.1		1.2
Total	22.7	20.9	48.2	4.0	12.0		107.8
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.3	0.8-1.4	0.7-1.8	0.6-1.1	0.5-1.1		0.5-1.8
Average	0.9	1.0	0.8	0.8	0.8		0.8
Total	12.8	12.6	35.3	4.0	9.0		73.7
Average Annual Dam ($1,000)							
Average	0.04	0.03	0.02	0.003	0.001		0.02
Total	0.67	0.42	0.66	0.01	0.01		1.77
Rate of Damages, Average							
Anl. Dam $/$1000 Value	29.50	20.10	13.70	2.50	0.83		16.40
Anl. Dam $/1000 Sq Ft	52.50	33.30	18.80	2.50	1.10		24.10
No. of Units in Sample	15	13	43	5	11	0	87
	Selected Samples						
Value ($1,000)	2.5	3.0	2.5	1.2	2.0		
Rate $/$1,000 Value	53.10	10.60	4.50	4.60	1.50		
Rate $/1,000 Sq Ft	151.00	26.00	9.40	6.80	4.00		
Value ($1,000)	1.8	1.5	1.2	0.8	1.0		
Rate $/$1,000 Value	31.10	26.50	21.50	1.60	1.20		
Rate $/1,000 Sq Ft	62.20	68.50	29.20	1.80	1.60		
Value ($1,000)	0.5	0.8	0.6	0.5	0.8		
Rate $/$1,000 Value	9.80	28.50	12.00	4.70	0.10		
Rate $/1,000 Sq Ft	7.00	27.80	13.00	2.00	0.10		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2as

Category and Class of Property: Resid., Personal Property, Frame, 1 story, with Basement, 1 Family, Seasonal

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	3	5	21	2	5	0	36
Value of Units ($1,000)							
Range	1.0-2.0	0.4-3.0	0.3-2.0	0.4-0.5	0.4-0.8		0.3-3.0
Average	1.4	1.7	1.1	0.45	0.7		1.1
Total	4.2	8.4	21.4	0.9	3.5		38.4
Area of 1st fl (1000 Sq Ft)							
Range	0.8-0.9	0.6-1.1	0.5-1.8	0.6-0.7	0.5-0.8		0.5-1.8
Average	0.9	0.9	0.8	0.6	0.6		0.8
Total	2.6	4.3	17.7	1.2	3.2		29.0
Average Annual Dam ($1,000)							
Average	0.09	0.07	0.01	0.004	0.002		0.03
Total	0.27	0.34	0.31	0.01	0.01		0.94
Rate of Damages, Average							
Anl. Dam $/$1000 Value	64.20	40.50	14.50	11.10	2.90		24.50
Anl. Dam $/1000 Sq Ft	101.40	78.40	17.30	6.90	3.30		32.00
No. of Units in Sample	3	5	21	2	5	0	36
Selected Samples							
Value ($1,000)	2.0	3.0	2.0	0.5	0.8		
Rate $/$1,000 Value	122.10	50.70	2.30	4.0	7.40		
Rate $/1,000 Sq Ft	246.20	155.00	8.90	4.40	9.90		
Value ($1,000)	1.2	1.4	1.0		0.7		
Rate $/$1,000 Value	2.50	56.80	14.90		1.00		
Rate $/1,000 Sq Ft	3.70	73.60	8.40		1.10		
Value ($1,000)	1.0	0.4	0.3	0.4	0.4		
Rate $/$1,000 Value	19.80	29.60	4.70	15.80	1.20		
Rate $/1,000 Sq Ft	23.60	21.10	2.80	10.00	0.80		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2d

Category and Class of Property: Resid., Personal Property, Frame, 1 Story, no Basement, 1 Family

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	200	110	312	85	91	0	798
Value of Units ($1,000)							
Range	0.4-3.0	0.4-3.0	0.3-3.0	0.3-3.5	0.5-2.8		0.3-3.5
Average	1.1	1.0	1.1	1.0	1.1		1.1
Total	219.8	114.4	327.7	88.7	101.4		852.0
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.3	0.6-1.7	0.4-1.6	0.5-1.2	0.5-1.2		0.4-1.7
Average	0.7	0.8	0.7	0.8	0.7		0.7
Total	141.8	82.8	233.6	65.7	64.1		588.1
Average Annual Dam ($1,000)							
Average	0.12	0.06	0.02	0.01	0.003		0.05
Total	23.54	6.20	7.58	0.61	0.25		38.20
Rate of Damages, Average							
Anl. Dam $/$1000 Value	107.10	54.40	23.10	6.90	2.40		44.80
Anl. Dam $/1000 Sq Ft	166.10	75.10	32.50	9.30	3.80		61.00
No. of Units in Sample	123	92	276	85	91		667
		Selected Samples					
Value ($1,000)	3.0	3.0	3.0	3.5	2.8		
Rate $/$1,000 Value	2.20	10.60	6.70	10.20	11.00		
Rate $/1,000 Sq Ft	6.00	26.00	15.00	36.00	28.00		
Value ($1,000)	1.0	2.0	1.0	2.0	1.0		
Rate $/$1,000 Value	206.50	64.20	4.60	7.70	0.90		
Rate $/1,000 Sq Ft	361.00	127.00	7.00	13.00	1.00		
Value ($1,000)	0.4	0.4	0.3	0.3	0.5		
Rate $/$1,000 Value	559.40	201.00	15.40	7.50	0.40		
Rate $/1,000 Sq Ft	688.00	115.00	6.00	6.00	0.10		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2dy

Category and Class of Property: Resid., Personal Property, Frame, 1 Story, no Basement, 1 Family, Year Round

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	87	24	56	6	5	0	178
Value of Units ($1,000)							
Range	0.8-3.0	0.8-2.0	0.8-3.0	1.0-3.5	1.0-2.8		0.8-3.5
Average	1.2	1.1	1.2	1.5	1.5		1.2
Total	104.4	26.4	67.2	9.0	9.0		216.0
Area of 1st fl (1000 Sq Ft)							
Range	0.5-1.2	0.6-1.3	0.4-1.2	0.6-1.2	0.6-1.1		
Average	0.7	0.7	0.8	0.8	1.0		0.7
Total	62.7	17.9	42.2	5.0	5.0		132.8
Average Annual Dam ($1,000)							
Average	0.13	0.06	0.03	0.01	0.01		0.08
Total	10.93	1.41	1.60	0.06	0.06		14.06
Rate of Damages, Average							
Anl. Dam $/$1000 Value	104.70	58.40	23.80	6.70	6.70		65.10
Anl. Dam $/1000 Sq Ft	174.20	78.80	37.90	12.20	12.10		105.90
No. of Units in Sample	10	6	24	6	5	0	51
			Selected Samples				
Value ($1,000)	3.0	2.0	3.0	3.5	2.8		
Rate $/$1,000 Value	35.10	64.20	6.70	10.20	11.00		
Rate $/1,000 Sq Ft	97.00	127.00	15.00	36.00	28.00		
Value ($1,000)	1.0	1.2	1.2	1.5	1.5		
Rate $/$1,000 Value	206.50	30.30	10.50	16.60	0.10		
Rate $/1,000 Sq Ft	361.00	36.00	15.00	39.00	0.10		
Value ($1,000)	0.8	0.8	0.8	1.0	1.0		
Rate $/$1,000 Value	103.70	63.30	219.90	2.40	0.90		
Rate $/1,000 Sq Ft	163.00	83.00	103.00	3.00	2.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2dc

Category and Class of Property: Resid., Personal Property, Frame, 1 Story, no Basement, 1 Family, Convertible

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	12	15	55	11	16	0	109
Value of Units ($1,000)							
Range	0.8-3.0	0.4-3.0	0.8-2.5	0.5-2.0	0.5-2.0		0.5-3.0
Average	1.2	1.2	1.1	1.1	1.4		1.2
Total	14.4	18.0	60.5	12.1	22.4		127.4
Area of 1st fl (1000 Sq Ft)							
Range	0.7-1.3	0.7-1.2	0.6-1.4	0.5-1.1	0.6-1.1		
Average	0.8	0.8	0.9	0.8	0.8		0.8
Total	9.9	12.0	47.4	8.3	13.0		90.6
Average Annual Dam ($1,000)							
Average	0.12	0.10	0.03	0.01	0.004		0.05
Total	1.48	1.48	1.85	0.13	0.07		5.01
Rate of Damages, Average							
Anl. Dam $/$1000 Value	102.80	82.20	30.60	10.70	3.10		39.30
Anl. Dam $/1000 Sq Ft	150.20	122.70	39.20	15.90	5.20		55.40
No. of Units in Sample	12	15	54	11	16	0	108
Selected Samples							
Value ($1,000)	3.0	3.0	2.5	2.0	2.0		
Rate $/$1,000 Value	2.20	10.60	0.90	7.70	1.50		
Rate $/1,000 Sq Ft	6.00	26.00	3.00	13.00	4.00		
Value ($1,000)	1.8	1.2	1.0	1.2	0.9		
Rate $/$1,000 Value	31.10	49.80	4.60	4.60	2.40		
Rate $/1,000 Sq Ft	62.00	77.00	7.00	7.00	3.00		
Value ($1,000)	0.8	0.4	0.8	0.8	0.5		
Rate $/$1,000 Value	29.20	98.30	11.20	1.60	3.00		
Rate $/1,000 Sq Ft	28.00	22.00	8.00	2.00	3.00		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name: Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
B-2ds

Category and Class of Property: Resid., Personal Property, Frame, 1 story, no Basement, 1 Family, Seasonal

Item	Flood Risk Zone by Frequency in Years 0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	101	71	201	68	70	0	511
Value of Units ($1,000)							
Range	0.4-2.5	0.4-1.5	0.3-1.5	0.3-2.0	0.5-1.4		0.3-2.5
Average	1.0	1.0	1.0	1.0	1.0		1.0
Total	101.0	70.0	200.0	67.6	70.0		508.6
Area of 1st fl (1000 Sq Ft)							
Range	0.6-1.2	0.6-1.7	0.4-1.6	0.5-1.2	0.5-1.2		0.4-1.7
Average	0.7	0.7	0.7	0.8	0.7		0.7
Total	69.2	52.9	144.0	52.5	46.1		364.7
Average Annual Dam ($1,000)							
Average	0.11	0.05	0.02	0.006	0.002		0.04
Total	11.13	3.33	4.12	0.42	0.12		19.12
Rate of Damages, Average							
Anl. Dam $/$1000 Value	110.20	46.90	20.60	6.20	1.70		37.60
Anl. Dam $/1000 Sq Ft	161.00	63.00	28.60	8.00	2.60		52.40
No. of Units in Sample	101	71	198	68	70	0	508
	Selected Samples						
Value ($1,000)	2.5	1.5	1.5	2.0	1.4		
Rate $/$1,000 Value	61.10	44.70	9.80	1.20	2.50		
Rate $/1,000 Sq Ft	230.00	90.00	20.00	3.00	6.00		
Value ($1,000)	1.4	1.0	1.0	1.0	1.0		
Rate $/$1,000 Value	77.60	116.50	30.80	7.40	0.90		
Rate $/1,000 Sq Ft	111.00	146.00	35.00	8.00	1.00		
Value ($1,000)	0.4	0.4	0.3	0.3	0.5		
Rate $/$1,000 Value	559.40	201.00	15.40	7.50	0.40		
Rate $/1,000 Sq Ft	688.00	115.00	6.00	6.00	0.10		

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study: Pilot
Name : Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
C-1a

Category and Class of Property: Commercial, Structural, Retail

Item	Flood Risk Zone by Frequency in Years						
	0-5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	14	10	24	3	1	0	51
Value of Units ($1,000)							
Range	4.0-46.0	2.3-123.0	3.3-26.5	5.7-16.1	5.7	0	
Average	13.7	29.3	11.2	10.0	5.7	0	
Total	191.2	292.6	268.9	29.9	5.7	0	788.3
Area of 1st fl (1000 Sq Ft)							
Range	.7-14.2	.2-8.0	.3-4.9	.6-2.3	.6	0	
Average	2.5	2.3	1.4	1.5	.6	0	
Total	34.9	23.3	33.2	4.5	6.6	0	96.5
Average Annual Dam ($1,000)							
Average	.57	.48	.22	.07	.02	0	
Total	7.9	4.8	5.4	0.2	.02	0	18.3
Rate of Damages, Average							
Anl. Dam $/$1,000 Value	41.70	16.20	20.00	7.50	4.50	0	
Anl. Dam $/1000 Sq Ft	226.70	204.30	161.90	50.00	39.70	0	189.60
No. of Units in Sample	14	10	24	3	1	0	
			Selected Samples				
Value ($1,000)	8.9	2.3	18.7	5.7			
Rate $/$1,000 Value	58.40	93.43	30.56	9.58			
Rate $/1,000 Sq Ft	422.00	895.00	257.00	67.00			
Value ($1,000)	11.5	5.4	14.1	16.1			
Rate $/$1,000 Value	60.34	79.81	31.67	6.99			
Rate $/1,000 Sq Ft	217.00	634.00	226.00	49.00			
Value ($1,000)	9.9	32.4	4.0	8.1			
Rate $/$1,000 Value	37.07	26.93	27.71	6.93			
Rate $/1,000 Sq Ft	354.00	283.00	96.00	42.00			

FLOOD INSURANCE STUDY

Rate of Average Annual Damages

Kind of Study : Pilot
Name : Wareham, Massachusetts
Source of Flooding: Tidal

TABLE
C2a

Category and Class of Property: Commercial, Personal Property, Retail

Item	Flood Risk Zone by Frequency in Years						
	0.5	5-10	10-25	25-50	50-100	100+	Totals
(Price level: 1966)							
Total No. of Units	14	10	24	3	1	0	51
Value of Units ($1,000)							
Range	1.3-112.5	2.0-167.0	2.4-115.0	13.0-63.4	2.5		
Average	14.5	30.6	17.6	30.6	2.5	0	
Total	203.3	306.4	423.0	91.9	2.5		1027.1
Area of 1st fl (1000 Sq Ft)							
Range	.7-14.2	.2-8.0	.3-4.9	.6-2.3	.6		
Average	2.5	2.3	1.4	1.5	.6		
Total	34.9	23.3	33.2	4.5	.6		96.5
Average Annual Dam ($1,000)							
Average	.70	1.07	.41	.27	.02		
Total	9.8	10.7	9.8	0.8	0.02		31.0
Rate of Damages, Average							
Anl. Dam $/$1000 Value	48.10	34.80	23.10	8.80	6.90		
Anl. Dam $/1000 Sq Ft	280.00	458.50	294.40	180.30	0.03	0	
No. of Units in Sample	14	10	24	3	1	0	51
		Selected Samples					
Value ($1,000)	11.5	4.4	64.0	15.5			
Rate $/$1,000 Value	48.70	46.84	25.73	11.78			
Rate $/1,000 Sq Ft	455.00	859.00	740.00	225.00			
Value ($1,000)	12.0	2.0	18.5	63.4			
Rate $/$1,000 Value	38.10	215.48	43.75	8.42			
Rate $/1,000 Sq Ft	143.00	634.00	482.00	231.00			
Value ($1,000)	8.5	65.0	5.5	13.0			
Rate $/$1,000 Value	56.56	69.10	36.80	6.87			
Rate $/1,000 Sq Ft	466.00	1456.00	176.00	66.00			

TABLE S-1

Summary of Damages and Values
Wareham, Massachusetts

Damages

Description		Annual Damage
Year-Round Homes-Struct.	$	60,850
Convertible Homes-Struct.		22,720
Seasonal Homes-Struct.		27,350
Commercial Property, Retail, Struct.		18,300
Commercial Property, Wholesale Struct.		1,480
Commercial Property, Marine, Struct.		2,690
Total Ann. Damages, Struct.	$	133,390
Year-Round Homes-Personal Property		19,540
Convertible Homes-Personal Property		9,740
Seasonal Homes -Personal Property		20,040
Commercial, Retail, Personal Property		31,000
Commercial, Wholesale Personal Property		2,750
Commercial Marine-Personal Property		9,360
Total Ann. Damages Personal Property	$	92,430

Values

Value, Year Round Homes	$	1,644,200
Value, Convertible Homes		1,178,400
Value, Seasonal Homes		2,284,100
Value, Commercial Properties		1,116,200
Total Value	$	6,222,900
Value Contents Year Round Homes	$	441,000
Value Contents Convertible Homes		235,200
Value Contents Seasonal Homes		547,000
Value Contents Commercial Properties		1,795,700
Total Value of Contents	$	3,018,900

TABLE H-1

TYPICAL INPUT DATA

FILE	T	STAGE LOSS-DATA IN $1000								AREA	R
H	11			.5	.8	1.8	3.3	4.7	5.9	7.3	957.	Y
H	12				.3	.6	1.3	1.8	2.	2.1	957.	Y
H	21		.7	1.2	2.7	3.6	4.5	5.1	5.7	6.4	918.	Y
H	22		.3	.3	.8	1.3	1.8	2.	2.1	2.3	918.	Y
H	81			.1	.4	.4	.5	2.7	4.5	6.1	900.	Y
H	82			.1	.2	.3	.3	1.	1.6	2.	900.	Y
H	131					1.1	1.5	3.2	4.8	6.8	1205.	Y
H	132					.4	.4	1.4	2.2	2.7	1205.	Y
H	221					2.3	3.4	4.	4.5	5.	860.	C
H	222							.2	.7	1.1	860.	C
H	231					1.1	1.9	2.8	3.7	4.2	970.	C
H	232							.1	.3	.6	970.	C
H	251				2.2	3.3	5.5	6.5	7.5	8.5	1500.	Y
H	252							1.	2.1	3.3	1500.	Y
H	271						1.2	1.8	2.4	3.0	660.	S
H	272						.1	.2	.5	.6	660.	S
H	301				1.2	1.9	3.6	4.4	5.2	5.7	700.	C
H	302						.1	.4	.6	.8	700.	C
H	321			.4	.8	2.4	3.1	3.8	4.5	5.3	890.	C
H	322						.1	.5	.8	1.1	890.	C
H	411				.4	1.8	3.2	4.2	5.1	6.	912.	S
H	412				.1	.6	1.2	1.6	1.8	1.9	912.	S
H	421				.2	.6	2.	3.1	4.2	5.3	896.	C
H	422				.1	.2	.6	1.2	1.5	1.7	896.	C
H	441					.2	.7	2.	3.3	3.9	552.	C
H	442					.3	.3	.7	1.1	1.4	552.	C
H	461						1.1	1.4	3.2	4.9	1208.	Y
H	462						.3	.3	1.	1.7	1208.	Y
H	501			.9	1.1	1.5	2.5	4.2	5.8	6.9	1060.	Y
H	502			.4	.4	.4	.9	1.9	2.4	2.7	1060.	Y
H	511	.1	.1	.4	.9	2.3	3.6	4.5	5.4	6.3	844.	C
H	512			.4	.4	.9	1.4	1.9	2.2	2.4	844.	C
H	551				.6	1.2	3.	4.6	5.2	5.8	896.	Y
H	552				.3	.3	.9	1.6	2.2	2.5	896.	Y
H	561			.8	1.1	1.6	3.8	5.8	7.8	9.8	1120.	Y
H	562			.3	.3	.3	1.1	1.7	2.2	2.5	1120.	Y
H	581			1.1	1.4	1.5	3.5	5.4	7.3	8.1	962	Y
H	582			.2	.2	.2	.6	1.2	1.6	1.9	962	Y

TABLE H-2

TYPICAL OUTPUT DATA

FILE NO.	TYPE OF RESID.	TYPE OF LOSS	FLOOD ZONE	ANNUAL LOSS	FLOOR AREA	SQFT LOSS
H 1	Y	1	3	156.52	957.	0.164
H 1	Y	2	3	54.03	957.	0.056
H 2	Y	1	2	296.37	918.	0.323
H 2	Y	2	2	105.47	918.	0.115
H 8	Y	1	3	79.12	900.	0.088
H 8	Y	2	3	33.28	900.	0.037
H 13	Y	1	3	87.84	1205.	0.073
H 13	Y	2	3	35.47	1205.	0.029
H 22	C	1	3	115.60	860.	0.134
H 22	C	2	5	7.92	860.	0.009
H 23	C	1	3	75.91	970.	0.078
H 23	C	2	5	3.77	970.	0.004
H 25	Y	1	3	255.15	1500.	0.170
H 25	Y	2	5	26.00	1500.	0.017
H 27	S	1	4	40.62	660.	0.062
H 27	S	2	4	6.30	660.	0.010
H 30	C	1	3	158.92	700.	0.227
H 30	C	2	4	8.49	700.	0.012
H 32	C	1	3	143.47	890.	0.161
H 32	C	2	4	10.96	890.	0.012
H 41	S	1	3	127.83	912.	0.140
H 41	S	2	3	44.03	912.	0.048
H 42	C	1	3	84.12	896.	0.094
H 42	C	2	3	30.00	896.	0.033
H 44	C	1	3	48.05	552.	0.087
H 44	C	2	3	19.85	552.	0.036
H 46	Y	1	4	46.88	1208.	0.039
H 46	Y	2	4	13.94	1208.	0.012
H 50	Y	1	3	155.62	1060.	0.147
H 50	Y	2	3	59.64	1060.	0.056
H 51	C	1	1	172.90	844.	0.205
H 51	C	2	3	67.73	844.	0.080
H 55	Y	1	3	127.67	896.	0.142
H 55	Y	2	3	48.30	896.	0.054
H 56	Y	1	3	193.57	1120.	0.173
H 56	Y	2	3	52.99	1120.	0.047
H 58	Y	1	3	193.17	962.	0.201
H 58	Y	2	3	36.05	962.	0.037

ACKNOWLEDGEMENTS AND IDENTIFICATION OF PERSONNEL

1. The preparation of this report was administered by:

Colonel Remi O. Renier, USA, Acting Division Engineer
John Wm. Leslie, Chief, Engineering Division
Edward L. Hill, Chief, Planning & Reports Branch

2. This report was prepared under the direction of Michael E. McArdle, Chief, Economics Section. The Fortran II Program for derivation of annual losses and rates of annual losses was developed by Nicholas Avtges of the Economics Section.

3. The U.S. Army Engineer Division, New England, is appreciative of the cooperation rendered in connection with this study by the Board of Selectmen and Board of Assessors of Wareham, Massachusetts.

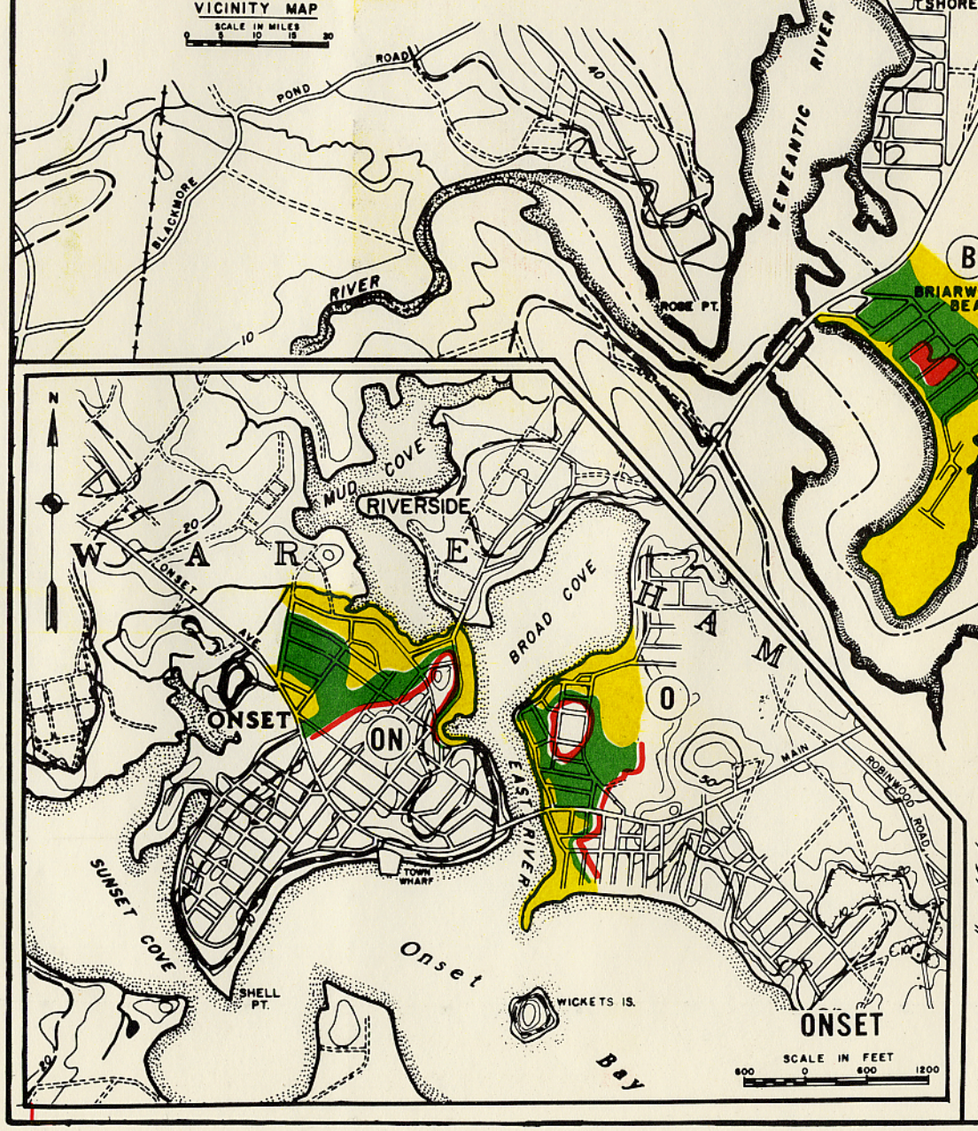
CORPS OF ENGINEERS

U. S. ARMY

VICINITY MAP

SCALE IN MILES

0 5 10 15 30



LEGEND

0 TO 5 YEAR FLOOD ZONE

5 TO 25 YEAR FLOOD ZONE

25 TO 50 YEAR FLOOD ZONE

FLOOD INSURANCE STUDY

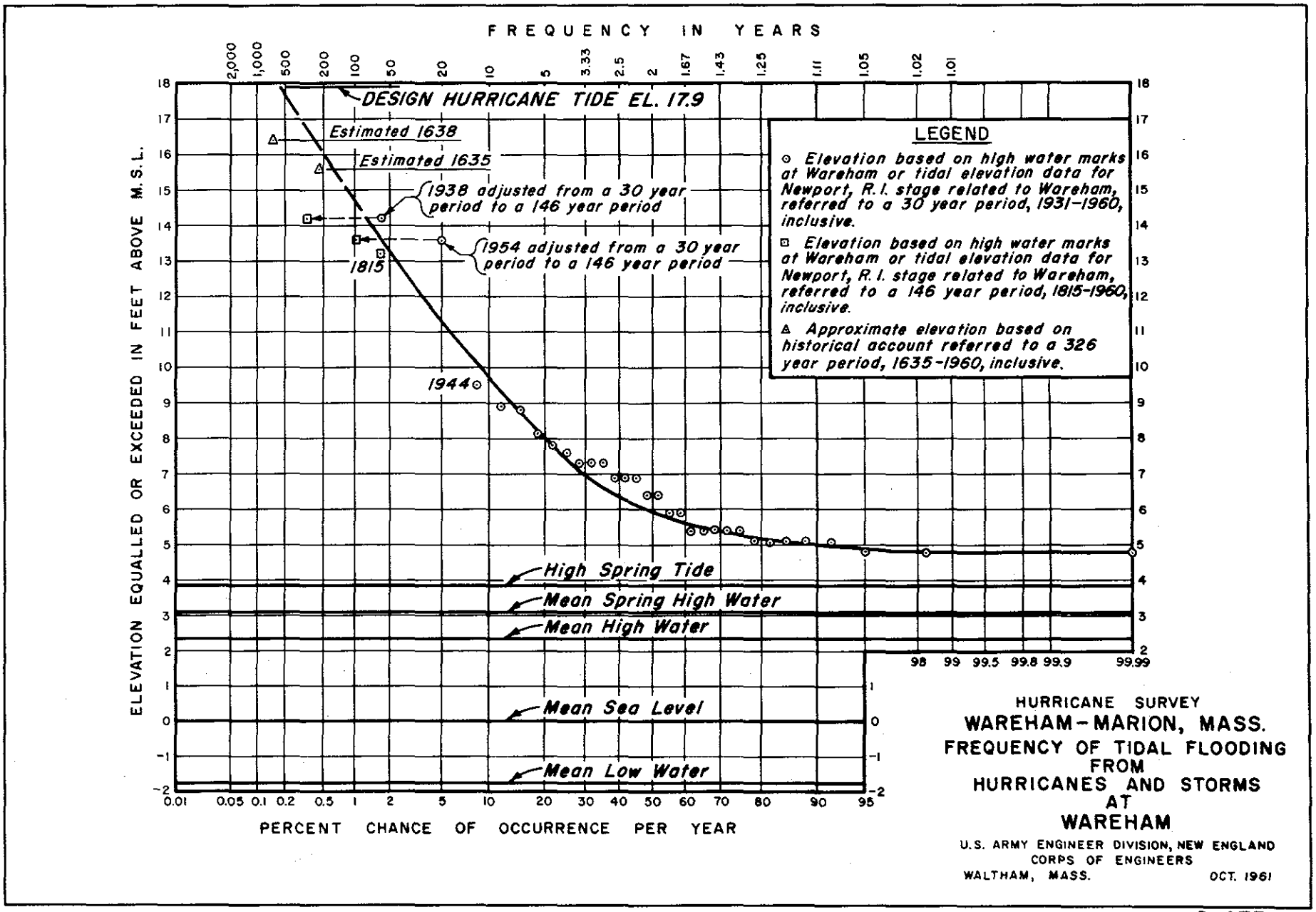
WAREHAM, MASS.

SCALE IN FEET

600 0 600 1200 1800

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

PLATE NO. 1



HURRICANE SURVEY

WAREHAM - MARION, MASS.

FREQUENCY OF TIDAL FLOODING FROM HURRICANES AND STORMS AT WAREHAM

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS. OCT. 1961

PLATE NO. 2

APPENDIX

Fortran Program For Annual Losses

Wareham, Massachusetts

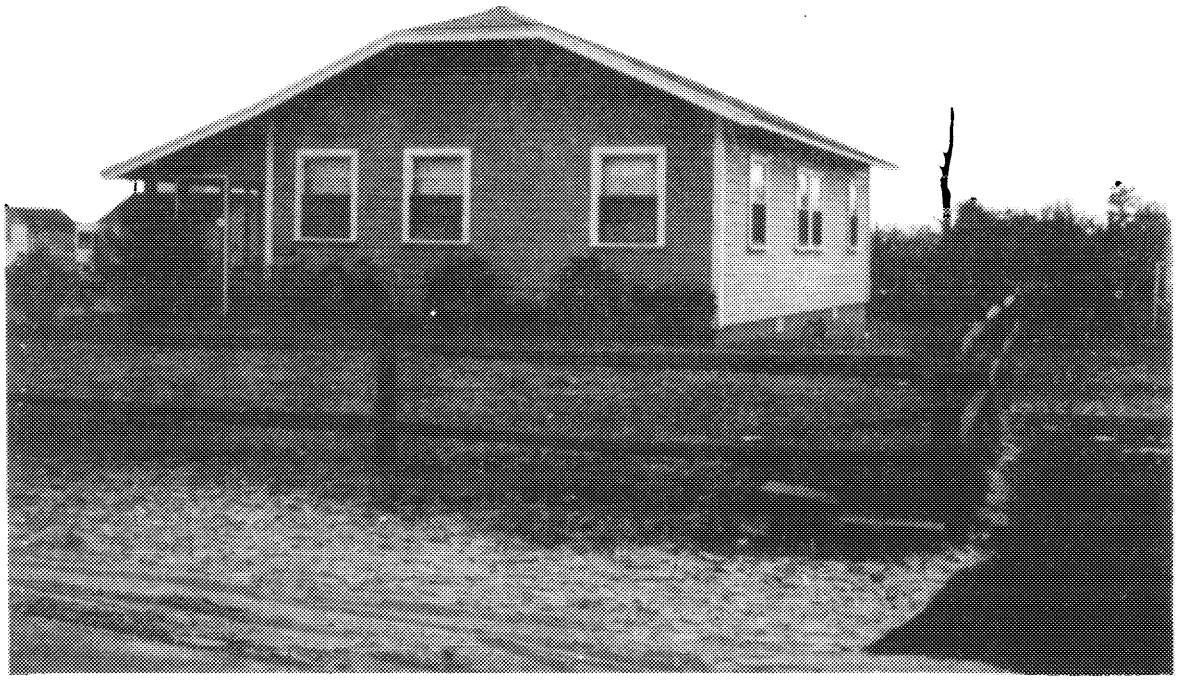
APPENDIX A

FORTRAN SOURCE LIST

```
C     THIS IS A GENERAL PROGRAM TO DETERMINE ANNUAL LOSSES
C     INPUT DATA REQUIRED
C         1. 38 ELEVATIONS TAKEN FROM A STAGE-FREQUENCY CURVE (ELEV)
C         2. NUMBER OF VALUES TAKEN FROM A STAGE-DAMAGE CURVE  (M)
C         3. ELEVATIONS TAKEN FROM A STAGE-DAMAGE CURVE (STAGE)
C         4. IDENTIFICATION NUMBER FOR EACH PROPERTY (FILE)
C         5. DAMAGE IN $1000 TAKEN FROM A STAGE-DAMAGE CURVE (DAMAG)


C     THIS PROGRAM COMPUTES 38 FREQUENCY VALUES AND WITH THE INPUT DATA
C     COMPUTES DAMAGE VALUES TO CORRESPOND WITH THE FREQUENCIES.
C     USING THE ARITHMETIC METHOD, ANNUAL LOSSES ARE FOUND


C     TYPE OF RESIDENCE
C         Y = YEARROUND
C         C = CONVERTIBLE
C         S = SEASONAL

C     TYPE OF LOSS
C         1 = STRUCTURES
C         2 = CONTENTS

C     FLOOD ZONE
C         1 =   0 -   5 ( 4.8 TO  8.0 )
C         2 =   5 -  10 ( 8.0 TO  9.6 )
C         3 =  10 -  25 ( 9.6 TO 11.7 )
C         4 =  25 -  50 (11.7 TO 13.2 )
C         5 =  50 - 100 (13.2 TO 14.7 )
C         6 = 100 PLUS  (14.7 TO 16.0 )


C     ANNUAL LOSSES FOR WAREHAM, MASS.

      DIMENSION FREQ(50),ELEV(50),STAGE(50),DAMAG(50),FAMAG(50)
      PUNCH 60
      PRINT 60
   60 FORMAT(1H1,5X,64HFILE NO.  TYPE OF  TYPE OF  FLOOD       ANNUAL
     1 FLOOR     SQFT )
      PRINT 61
      PUNCH 61
   61 FORMAT(16X,53HRESID.    LOSS   ZONE         LOSS     AREA      LOS
     1S )
      DO 1 I=1,11
      XI = I-1
    1 FREQ(I) =XI/1000.
      XJ = 10
```

```
      DO 2  I=12,19
      XJ = XJ +5.
    2 FREQ(I) = XJ/1000.
      XJ = 5
      DO 3 I=20,38
      XJ=XJ+5.
    3 FREQ(I) =XJ/100.
      READ 4,(ELEV(I),I=1,38)
    4 FORMAT (11F7.2)
    5 READ 6,M
    6 FORMAT(I10)
      READ 44,(STAGE(I),I=1,M)
   44 FORMAT(14F5.1)
    8 READ 9,FILE,ITYPE,(DAMAG(I),I=1,M),AREA,RES
    9 FORMAT(A6,I1,6F4.1,8F5.1,F6.0,A3)
      IF(ITYPE-9)  13,21,21
   13 DO 10 I=1,M
   10 DAMAG(I)= DAMAG(I)*1000.
C     FAMAG = DAMAGE FOR KNOWN FREQUENCY
      DO 11 I=1,38
      IF(STAGE(1)-ELEV(I)) 12,12,14
   14 FAMAG(I)= 0
      GO TO 11
   12 J=1
      GO TO 16
   15 J=J+1
   16 IF(ELEV(I)-STAGE(J))17,18,22
   17 Y=STAGE(J)-STAGE(J-1)
      X=DAMAG(J)-DAMAG(J-1)
      Z=ELEV(I)- STAGE(J-1)
      W=Z*X/Y
      FAMAG(I)=DAMAG(J-1)+W
      GO TO 11
   22 IF(J-M) 15,23,15
   23 A=DAMAG(M)-DAMAG(M-1)
      B=STAGE(M)-STAGE(M-1)
      C=ELEV(I)-STAGE(M)
      X=A*C/B
      FAMAG(I)=DAMAG(M)+X
      GO TO 11
   18 FAMAG(I)=DAMAG(J)
   11 CONTINUE
      SUM =0
      DO 19 I =1,37
      ANDAM = ((FAMAG(I)+FAMAG(I+1))/2.)*(FREQ(I+1)-FREQ(I))
   19 SUM = SUM + ANDAM
      SQAR =SUM/AREA
      DO 301 I=1,17
      II = 39 -I
      IF(FAMAG(II)) 300,301,300
  301 CONTINUE
      DO 302 I=18,19
      II = 39 - I
      IF(FAMAG(II)) 303,302,303
```

```
302 CONTINUE
    DO 304 I=20,22
    II = 39 - I
    IF (FAMAG(II)) 305,304,305
304 CONTINUE
    DO 306 I=23,26
    II = 39 - I
    IF(FAMAG(II)) 307,306,307
306 CONTINUE
    DO 308 I=27,28
    II = 39 - I
    IF (FAMAG(II))309,308,309
308 CONTINUE
    DO 310 I=29,38
    II = 39- I
    IF(FAMAG(II)) 311,310,311
310 CONTINUE
    GO TO 311
300 LZONE = 1
    GO TO  333
303 LZONE = 2
    GO TO  333
305 LZONE = 3
    GO TO  333
307 LZONE = 4
    GO TO  333
309 LZONE = 5
    GO TO  333
311 LZONE = 6
333 PRINT20,FILE,RES,ITYPE,LZONE,SUM,AREA,SQAR
    PUNCH20,FILE,RES,ITYPE,LZONE,SUM,AREA,SQAR
 20 FORMAT(5X,A6,5X,A3,I9,I8,4X,F10.2,F9.0,F9.3)
    GO TO 8
 21 STOP
    END
```



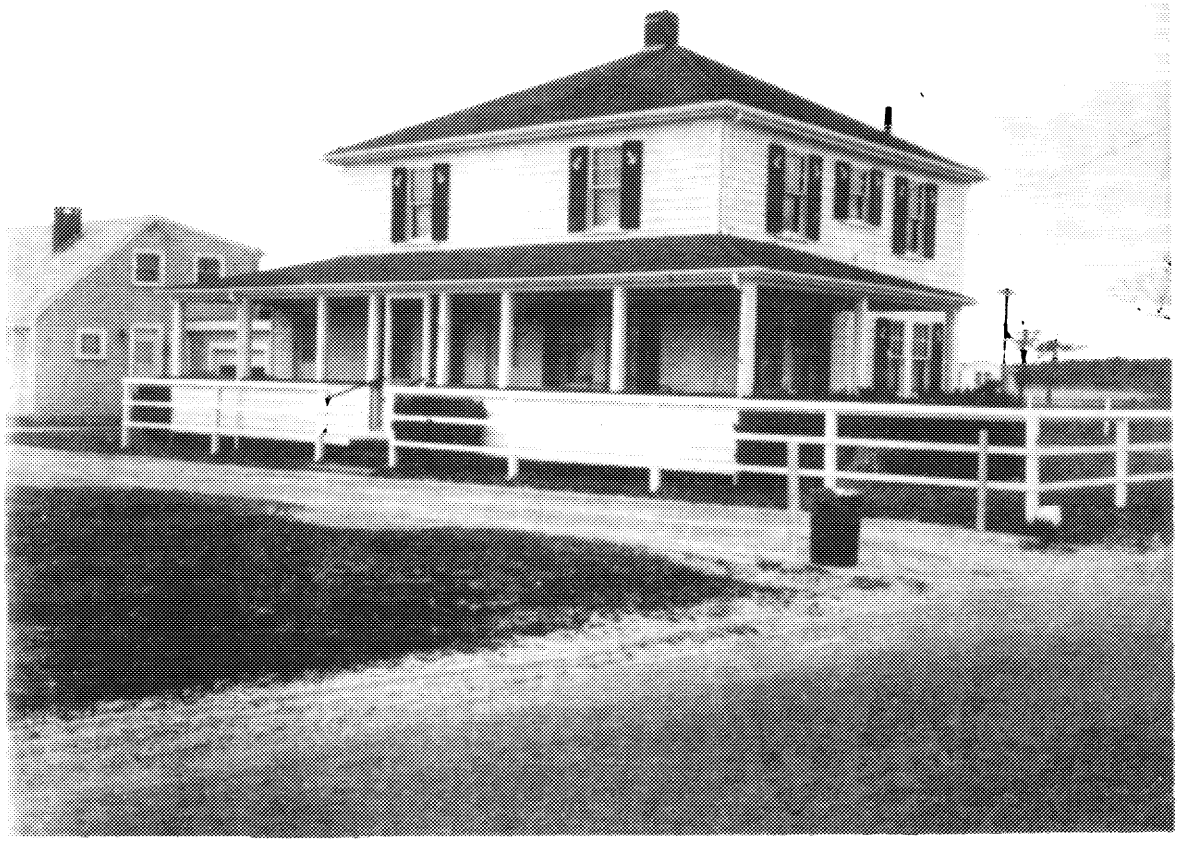
TYPICAL YEAR ROUND PROPERTY
Shore Ave., Swift's Neck,Wareham,Mass.

TYPICAL SEASONAL PROPERTY
Pleasant St.,Swift's Beach,Wareham,Mass.

TYPICAL YEAR ROUND PROPERTIES
Pilgrim Ave.,Hamilton Beach,Wareham,Mass.

TYPICAL SEASONAL PROPERTIES
Pearl Ave.,Hamilton Beach,Wareham,Mass.

TYPICAL SEASONAL PROPERTY
Lake St.,Swift's Neck,Wareham,Mass.



TYPICAL SEASONAL PROPERTY
Wankinco Ave.,Swift's Beach,Wareham,Mass.